

Claims

What is claimed is:

1. An optical device for measuring a distance between the optical device and an object, the optical device comprising:
 - an optical source for emitting a beam of electromagnetic radiation;
 - a focusing optical member for focusing the beam of electromagnetic radiation into a micro-mirror incident pattern;
 - a micro-mirror array receiving the micro-mirror incident pattern and outputting a controlled radiation pattern;
 - a processor for selecting a resolution level of the controlled radiation pattern based on a previous lower resolution scan over a greater area; and
 - a transmission optical member for focusing the controlled radiation pattern toward an object for estimation of a distance of the object from the optical device.
2. The optical device according to claim 1 wherein the micro-mirror array comprises a microelectromechanical system.
3. The optical device according to claim 1 wherein the micro-mirror array comprises an array of deformable reflective members and a controller for controlling the deformable reflective members to direct the controlled radiation pattern.
4. The optical device according to claim 1 further comprising a beam adjuster, the beam adjuster activating successive members of the micro-mirror array prior to the time that a change in the position of the member is actually required to reduce a response time of the micro-mirror array.
5. The optical device according to claim 1 wherein the controlled radiation pattern has a beam size determined by reflective contributions from multiple reflective members of the micro-mirror array.

6. The optical device according to claim 1 wherein the controlled radiation pattern comprises a first beam with a lower resolution and a second beam with a higher resolution, the first beam providing first scan data to identify a local area of interest within a global area of the second scan data associated with the local area of interest.
7. The optical device according to claim 1 wherein the optical source comprises a laser, the focusing optical member comprises a lens, and the transmission optical member comprises a lens.
8. The optical device according to claim 1 further comprising an intensity filter intercepting a path of the controlled radiation pattern for limiting the maximum distance of at least one of a global area of interest and a local area of interest.
9. The optical device according to claim 1 further comprising at least one frequency-selective filter intercepting a path of a reflection of the controlled radiation pattern from the object for filtering a reflected radiation pattern from the object to estimate an approximate color of the object.
10. The optical device according to claim 1 wherein a first scan is directed to a background object and a potential foreground object and wherein a second scan is directed at the potential foreground object to verify the presence or absence of the potential foreground object.
11. The optical device according to claim 1 wherein a first scan data is directed to a global region of interest and a second scan is directed to a local region of interest, the local region of interest representing a discontinuity associated with an object, a discontinuity representing a material change in the an amplitude of a reflection of the controlled radiation pattern from the object or an absence of the reflection within a predefined vicinity of the object.

12. The optical device according to claim 11 wherein the discontinuity represents a break or interruption in a crop edge of a field.
13. The optical device according to claim 1 wherein a color camera is used to identify regions of like color that may correspond to surfaces of the object at given distances.
14. The optical device according to claim 1 further comprising
 - a lens for collecting a reflection of the controlled radiation pattern from the object;
 - a detector for receiving the reflection and providing an output signal to the processor; and
 - a timer associated with the processor for determining an elapsed time between transmission of an identifiable pulse of electromagnetic radiation from the source and the reception of the reflection of the identifiable pulse at the sensor, the elapsed time indicative of a distance between the optical device and the object.
15. The optical device according to claim 14 wherein a filter is interposed between the lens and the sensor, the filter adapted to filter or reject at least one frequency of reflected electromagnetic radiation associated with the object.
16. An optical system for determining the range of an object, the optical system comprising:
 - an optical source of electromagnetic radiation,
 - a first transmitting lens for focusing or collimating the electromagnetic radiation;
 - a micro-mirror array for directing the focused electromagnetic radiation in a defined direction or pattern,
 - a second transmitting lens for focusing the electromagnetic radiation reflected from the micro-mirror array;
 - a processor arranged to control the micro-mirror array to direct the focused

radiation in the defined direction or pattern toward an object, the focused radiation having a resolution selected between a lower resolution scan over a greater area or a higher resolution scan over a lesser area of interest based on a previous lower resolution scan over the greater area; and

a receiving lens for receiving electromagnetic radiation reflected from the object;

a detector for detecting the receipt of the reflected electromagnetic radiation;

a timer for determining an elapsed time between transmission of the electromagnetic radiation to the object and receipt of the electromagnetic radiation from the object;

a converter for converting the elapsed time into a distance between the object and the optical system.

17. A method for determining a distance of an object from a reference point, the method comprising:

emitting electromagnetic radiation;

focusing the electromagnetic radiation upon a micro-mirror array;
directing the focused electromagnetic radiation in a defined direction or defined radiation pattern toward an object, consistent with a lower resolution scan over a greater area or a higher resolution scan over a lesser area of interest based on a previous lower resolution scan over the greater area; and

receiving electromagnetic radiation reflected from the object;

detecting the receipt of the reflected electromagnetic radiation;

determining an elapsed time between transmission of the electromagnetic radiation to the object and receipt of the electromagnetic radiation from the object;
and

converting the elapsed time into a distance between the object and the reference point.

18. The method according to claim 17 further comprising:

filtering the emitted electromagnetic radiation received to control the intensity

range of the focused electromagnetic radiation upon the micro-mirror array.

19. The method according to claim 17 further comprising:

filtering the reflected electromagnetic radiation received to control the intensity range of incident electromagnetic radiation upon the detector.

20. The method according to claim 17 further comprising:

filtering the reflected electromagnetic radiation from an object in a frequency-selective manner to estimate an approximate color of the object.

21. The method according to claim 17 further comprising:

directing the lower resolution scan to a background object and a potential foreground object;

directing the higher resolution scan at the potential foreground object to verify the presence or absence of the potential foreground object at a particular spatial position.

22. The method according to claim 17 further comprising:

directing the lower resolution scan to a global region of interest;

directing the higher resolution scan to a global region of interest;

directing the higher resolution scan to the local region of interest representing a discontinuity associated with an object, a discontinuity representing a material change in an amplitude of a reflection of the controlled radiation pattern from the object or an absence of the reflection within a predefined vicinity of the object.

23. The method according to claim 22 wherein the discontinuity represents a break or interruption in a crop edge of a field.

24. The method according to claim 17 further comprising

identifying regions of like color that may correspond to surfaces of the object at given distances.

25. The method according to claim 17 further comprising:

scanning for the lower resolution scan and a second beam for the higher resolution scan, the first beam providing first scan data to identify a local area of interest within a global area of interest, the second scan data associated with the local area of interest.

26. The method according to claim 17 further comprising:

processing at least one of a red component, a green component, a blue component, and a near infrared component to determine a color of the object.